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Monticello Remedial Action Project

Proposed Plan for the Remedial Action at the Monticello Millsite Monticello, Utah

October 1989

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Grand Junction
Projects Office

MONTICELLO REMEDIAL ACTION PROJECT

Proposed Plan for the Remedial Action at the Monticello Millsite Monticello, Utah

October 1989

PROPOSED PLAN
MONTICELLO MILLSITE

INTRODUCTION

The purpose of this document is to identify the Department of Energy's proposed plan for cleanup activities at the Monticello Millsite in Monticello, Utah. In addition, the Plan includes summaries of three alternatives analyzed for this site. This environmental document was developed in compliance with Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. This document is issued by the Department of Energy, the U.S. Environmental Protection Agency, and the State of Utah. The contents of this document are intended to:

- Describe the setting and background of the site.
- Describe the remedial alternatives analyzed for the site.
- Identify the preliminary decision on the preferred alternative and explain the rationale for its preference.
- Highlight key information available to the reader which contains additional information on the Monticello Millsite.
- Solicit community involvement in selection of a remedy.

The Department of Energy, in consultation with the Environmental Protection Agency and the State of Utah, will select a final remedy for the site only after the public comment period has ended and information submitted during the comment period has been reviewed and considered.

This document summarizes information that can be found in greater detail in the Remedial Investigation and Feasibility Study-Environmental Assessment report and other documents contained in the administrative record file for this site. The Department of Energy, the Environmental Protection Agency, and the State encourage the public to review these other documents in order to gain a more comprehensive understanding of the site and Superfund activities that have been conducted there. The administrative record file, which contains the information upon which the selection of the response action will be based, is available at the following locations:

San Juan Public Library
80 North Main Street
Monticello, Utah 84535
(801)587-2281

and

U.S. Environmental Protection Agency Docket Room
Room VIII
999 18th Street, Suite 500
Denver, Colorado 80202-2405
(303)293-1793

The Department of Energy, in consultation with the Environmental Protection Agency and the State, may modify the preferred alternative or select another response action presented in this Plan and Remedial Investigation and Feasibility Study-Environmental Assessment Report based on new information or

public comments. Therefore, the public is encouraged to review and comment on all the alternatives identified here.

SETTING AND BACKGROUND

Monticello is located in San Juan County, which occupies the southeastern corner of Utah (Figure 1). The town, which has a current population of approximately 1,900, lies in the Paradox Basin just east of the Abajo Mountains and north of Montezuma Creek. The millsite is situated in a gently sloped alluvial valley formed by Montezuma Creek, a small intermittent stream with headwaters in the Abajo Mountains immediately west of Monticello. The major highway in the Monticello area is U.S. Highway 191, which runs generally in a north-south direction, connecting Monticello with Moab 56 miles to the north and with Blanding 22 miles to the south.

The original Monticello mill was financed by the United State Government through its agent, the Defense Plant Corporation, to provide an additional source of vanadium needed during World War II. The Vanadium Corporation of America operated the mill for the Government between 1942 and 1944, and privately under a lease from the Government from 1944 to 1946. The U.S. Atomic Energy Commission reactivated the mill in 1948 and engaged the Galigher Company to rebuild it. The mill was operated for the Atomic Energy Commission from 1949 to 1956 by the Galigher Company, and from 1956 through 1959 by the National Lead Company, under cost-type contracts to produce both uranium and vanadium. During the years following Atomic Energy Commission takeover of the mill uranium was the primary product. Mill operations were terminated on 1 January 1960, and the plant was dismantled and excessed by the end of 1964. The mill-tailings piles were stabilized over the period 1961 to 1962 to prevent further contamination through erosion.

The tailings piles, as presently located at the millsite, are within the floodplain of Montezuma Creek. They are also partially in contact with a shallow alluvial aquifer underlying the site. This alluvial aquifer is not used as a private or public drinking water source and is separated by two aquitards (barriers) from the deeper Burro Canyon aquifer. The Burro Canyon, which is currently used as a drinking water supply, has not been contaminated. The alluvial aquifer is in direct hydraulic contact with Montezuma Creek.

An estimated 1.5 million cubic yards of tailings and contaminated substrate exist on the millsite. The tailings and associated contaminated material present a potential threat to human health and the environment.

Contamination from the millsite was spread to the local community and properties peripheral to the site. Tailings were used as fill for open lands; backfill around water, sewer, and electrical lines; sub-base for driveways, sidewalks, and concrete slabs; backfill against basement foundations; and as sand mix in concrete, plaster, and mortar. Tailings were also dispersed by wind to land adjacent to the millsite, and have contaminated the surface soils and ground water of peripheral properties downgradient from the site. Adjacent land known as "Peripheral properties" contain an estimated additional 300,000 cubic yards of contaminated material, while vicinity properties in Monticello account for an estimated 100,000 cubic yards, which are being relocated to the millsite under a separate action.

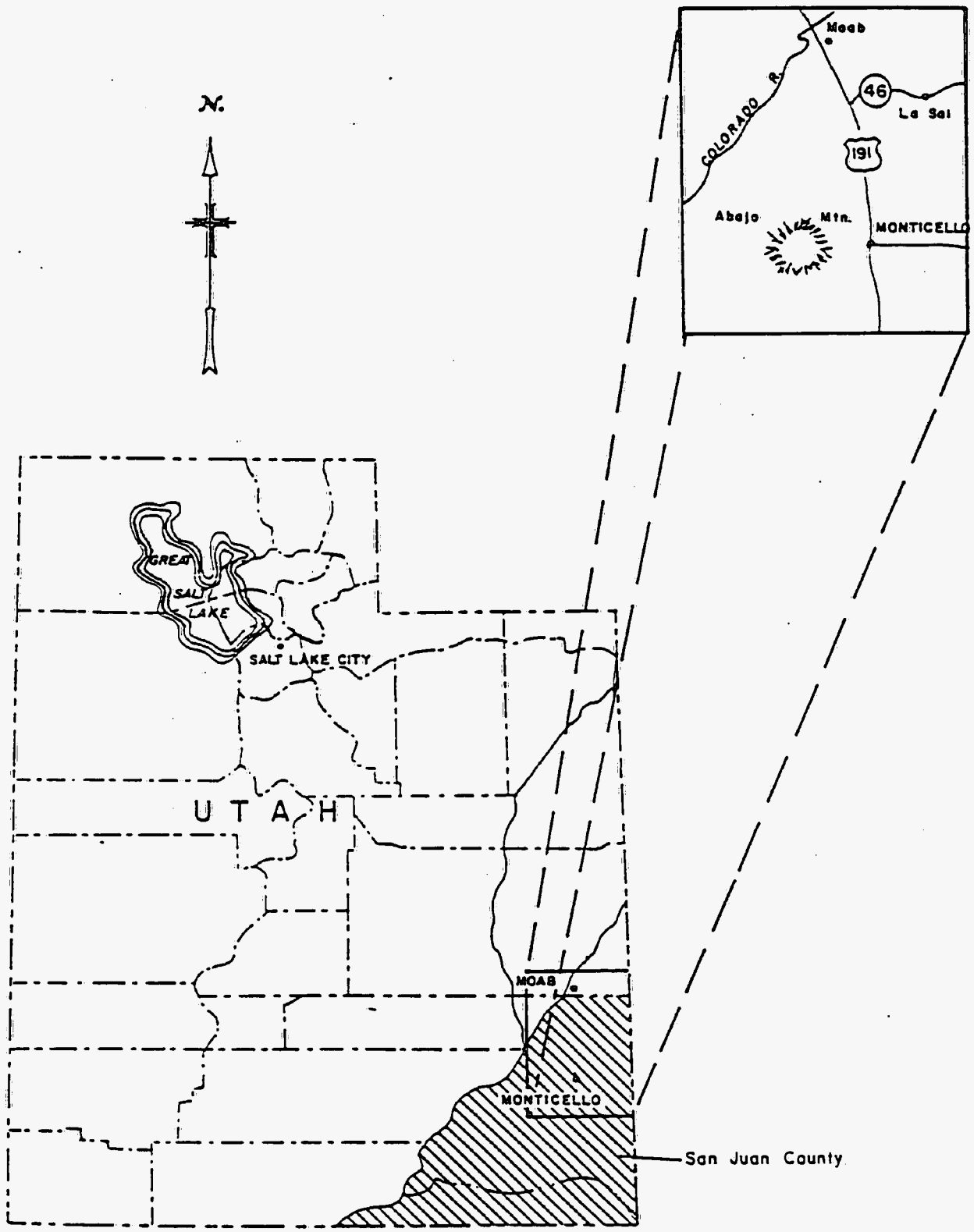

Figure 1 Monticello, Utah, Regional Location Map

Radiologic constituents of concern include products of the uranium-238 decay cycle, including radium-226. Non-radiologic constituents typically found in the mill tailings include most of the trace elements, specifically antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, thallium, vanadium, and zinc. With the exception of molybdenum, all of the trace elements are listed as hazardous substances at 40 Code of Federal Regulations Part 302.4.

Concern regarding the potential health hazards that result from exposure to radiation emanating from uranium mill tailings and from contaminated structures in the vicinity of such sites ('vicinity properties' or 'peripheral properties') prompted the U.S. Congress to enact legislation which authorized the Department of Energy to undertake remedial action to prevent or minimize this type of environmental hazard. The Uranium Mill Tailings Radiation Control Act of 1978 authorized remedial action at inactive uranium-mill-tailings sites owned and operated by private industry. Since the Monticello mill is Federally owned and does not fall in this category, it was accepted into the Department of Energy's Surplus Facilities Management Program late in 1980, with the intent of implementing remedial action.

The Surplus Facilities Management Program was developed in 1978 under the authority of the Atomic Energy Act to assure safe caretaking and decommissioning of government facilities that had been retired from service but still had radioactive contamination. The Monticello Remedial Action Project was then established to restore the government-owned millsite to safe levels of radioactivity and to dispose of or contain the tailings in an environmentally safe manner. The Monticello Remedial Action Project is currently conducted by the Grand Junction Projects Office of the Department of Energy.

The passage of the Superfund Amendments and Reauthorization Act of 1986 placed additional administrative requirements for the Surplus Facilities Management Program activities at Monticello under the regulatory framework of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This included the requirement of entering into a Federal Facilities Agreement with the Environmental Protection Agency and the State of Utah. This agreement became effective February 24, 1989. A Hazard Ranking System score for the millsite has been developed which is above the 28.5 score necessary for inclusion on the National Priorities List. The Environmental Protection Agency proposed the inclusion of Monticello Remedial Action Project on the National Priorities List in 54 Federal Register 29820, dated July 14, 1989.

In April 1989, the DOE completed a draft Remedial Investigation/Feasibility Study-Environmental Assessment document for the Monticello Millsite. The draft Remedial Investigation/Feasibility Study-Environmental Assessment describes and characterizes the site, provides an assessment of the extent of radioactive and nonradioactive contamination and presents a health-based risk assessment. In addition, the Remedial Investigation/Feasibility Study was supplemented to include analyses sufficient to enable the Department of Energy to assess the impacts of the remedial action alternatives considered in terms of the requirements of the National Environmental Policy Act. As such, the Remedial Investigation/Feasibility Study also serves as an Environmental Assessment for the purposes of National Environmental Policy Act. After review by the Environmental Protection Agency and the State of Utah, the

Department of Energy prepared the Remedial Investigation/Feasibility Study-Environmental Assessment into its final form for public review. The Remedial Investigation/Feasibility Study-Environmental Assessment document should be used to supplement the information found in this proposed plan and is available as part of the administrative record.

The Environmental Protection Agency, the State of Utah, and the Department of Energy have agreed to conduct the response action(s) at the site pursuant to the Federal Facilities Agreement of December 1988 under Section 120 of Comprehensive Environmental Response, Compensation, and Liability Act, as amended by Superfund Amendments and Reauthorization Act .

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Applicable or Relevant and Appropriate Requirements for the Monticello Remedial Action Project are the standards for which cleanup activities are based. These standards were adopted in March, 1983, by the Environmental Protection Agency and are known as the Standards for Remedial Action at Inactive Uranium Processing Sites (40 Code of Federal Regulations Part 192). The Environmental Protection Agency standards established guidelines for the control of tailings piles, cleanup of buildings, and cleanup of open lands. The Department of Energy has adopted the concentration limits and associated requirements of the Environmental Protection Agency standards into the Department of Energy guidelines for residual radioactive material. As a result the standards applied to the Monticello Remedial Action Project remedial actions are consistent with the EPA standards for Uranium Mill Tailings Remedial Action sites. The Department of Energy has also adopted "hot spot" criteria from its own guidelines. These standards are presented in detail in the Appendix A.

Other Applicable or Relevant and Appropriate Requirements that also apply include:

- U.S. Clean Water Act
- U.S. Occupational Safety and Health Act
- Utah Occupational Safety and Health Standard
- Several Utah Bureau of Water Pollution Control Standards
- Several Utah Air Conservation Rules
- Several Utah Bureau of Radiation Control Standards
- U.S. National Historic Preservation Act
- U.S. Archaeological and Historical Preservation Act
- U.S. Fish and Wildlife Coordination Act
- U.S. Endangered Species Act

SCOPE AND ROLE OF ACTION

The problems at the Monticello Millsite are complex. As a result, the Department of Energy has divided the work into three manageable components called "Operable Units". Operable units are used to differentiate the contaminated media and to provide a mechanism for developing and evaluating alternatives for the specified medium of concern for the Monticello Remedial Action Project. The proposed scope and role of remedial action, by operable unit is:

Operable Unit I -- Tailings

Remedial action associated with Operable Unit 1 would prevent the tailings from future contamination of air, surface soil, and groundwater. The tailings must be removed from their present location where they are in contact with the groundwater. Stabilization would occur adjacent to the existing site or off-site by capping with a clay and multimedia cap. Removal can be by conventional earthmoving equipment. Dust control measures and access restrictions would be used to protect public health. To control runoff, diversion structures would be built with collected water treated by evaporation ponds or reverse osmosis. Treated water would be discharged to Montezuma Creek. Contaminated residual sludges from either of the treatment systems would be disposed of at a licensed repository. Upon completion, the millsite and repository site would be revegetated.

Operable Unit II -- Peripheral Properties

Tailings would be removed from peripheral properties to eliminate current radiation exposure to the public by using conventional construction equipment and placed on the existing tailing pile for eventual disposal with the tailings. Revegetation would occur after remediation. Supplemental standards could be used in areas where remedial action would cause undue environmental damage or costs of remedial action would be unreasonably high in comparison to the derived environmental and health benefits. For some areas where supplemental standards could apply, access restrictions would be used to control the use of the land to prevent future exposure.

Operable Unit III - Ground Water

Groundwater remediation is intended to eliminate existing contamination once the source (tailings) are removed. Both active and passive treatment technologies were evaluated. Active ground-water treatment would, based on preliminary studies, involve the use of wells and/or drains to collect the ground water followed by treatment by reverse osmosis or evaporation ponds. Discharge of treated water for reverse osmosis would be to Montezuma Creek. Contaminated residual sludges from either of the treatment systems would be disposed of at a licensed repository. During the time that treatment takes place, institutional controls would be used to limit access to ground-water use. Upon completion of the ground-water restoration, the treatment site would be revegetated and made available for unrestricted use.

Passive treatment of ground water is also an acceptable alternative and would entail natural flushing over 60 years and institutional controls to limit access to ground-water use.

SUMMARY OF SITE RISKS

During the Remedial Investigation/Feasibility Study, an analysis was conducted to estimate the health or environmental problems that could result if the soil contamination at the Monticello Millsite was not cleaned up. This analysis is commonly referred to as a baseline risk assessment. In conducting this assessment, the focus was on the health effects that could result from the following six exposure pathways for radioactive and/or non-radioactive contaminants:

- Inhalation of radon and radon daughters.
- Direct exposure to gamma radiation emitted from the tailings.
- Inhalation and ingestion of airborne particulates.
- Ingestion of contaminated soil.
- Ingestion of contaminated foods produced in areas contaminated by the tailings.
- Ingestion of shallow alluvial groundwater and surface water contaminated by the tailings.

Risk Assessment of Radioactive Contaminants

The adverse health effects of radon emanations from tailings arise from inhalation of the short-lived radon-daughter products, which can expose the lungs to their full radiation dose. Interpretation of the data reveals that the major contributor to the overall risk to Monticello residents is natural background radiation, while the enhanced conditions increase total risk to levels approximately 40 percent above background. Health effects from enhanced conditions are those resulting from the tailings piles and contaminated peripheral properties in their present state.

Risk Assessment of Non-Radioactive Contaminants

The available data suggest that there may be a potential for adverse health effects resulting from chronic exposure to contaminated soils, water, vegetables, and beef. However, this is largely dependent on individual activities which can be controlled.

Comparison of concentrations with the acceptable intakes for chronic exposure resulted in no apparent need for concern. When average soil concentrations were used, none of the dose levels were exceeded. When maximum soil concentrations were used, copper, uranium (including the vegetable pathway) and zinc (including or excluding the vegetable pathway) exceeded recommended levels for children. However, because of the low population densities and land use patterns in the area, it is unlikely that individuals would receive chronic exposures to these maximum concentrations.

The comparison of the shallow alluvial ground-water and surface-water sampling data to State and Federal water quality standards shows several elements to be above these standards:

- Gross Alpha-particule Activity
- Arsenic
- Molybdenum
- Nitrate
- Combined Radium 226/228
- Manganese
- Selenium
- Zinc
- pH
- Iron
- Sulfate

The potential exposure to these concentrations suggests that this water should not be used for drinking by humans or cattle and that remedial action needed

to be taken to improve surface water quality. Use of this water to irrigate the alfalfa on which cattle graze appears to be acceptable because average exposure doses do not exceed the acceptable intakes for chronic exposure. However, it is recommended that vegetables not be grown in the Montezuma Creek floodplain. Under worst case conditions (maximum soil concentrations), the addition of the vegetable pathway causes the calculated dose of uranium and copper for children to exceed the acceptable intakes for chronic exposure.

Arsenic is a special case because it is considered a carcinogen by the EPA. There appear to be no likely health effects when calculated arsenic doses are compared to the acceptable intakes from chronic exposure. However, calculated cancer risks exceed health goal range of 1×10^{-4} to 1×10^{-7} lifetime cancer risk. On the basis of this information, arsenic may pose a public health impact.

In conclusion, actual or threatened releases of hazardous substances from this site, if not addressed by the preferred alternative or one of the other active measures considered, may present an endangerment to public health, welfare, or the environment.

SUMMARY OF ALTERNATIVES FOR OPERABLE UNIT I -- TAILINGS

The alternatives analyzed for Operable Unit I are presented below. These are numbered to correspond with the number in the Remedial Investigation/ Feasibility Study-Environmental Assessment report.

- Alternative 1 -- On-site stabilization south of present site
- Alternative 2 -- Removal to a licensed repository
- Alternative 3 -- No action

Common Elements. Except for the "no action" alternative, all of the alternatives now being considered for the tailings stabilization would be essentially identical except for location. Common elements would include: removal of tailing from the millsite; construction or use of a repository that is not in contact with groundwater; haul and placement of the tailings in compacted lifts within the repository; the cover would be capped with additional soil to protect the repository from frost penetration and water percolation; and the entire repository would be designed to have a minimum 1,000 year life. Each alternative also includes long-term ground-water monitoring in compliance with 40 Code of Federal Regulations 192.

Operable Unit I - Alternative 1 - On site stabilization south of present site

Capital Cost: $52,000,000

Annual Operation/Maintenance Costs: $41,000

Present Worth: $42,000,000

Years to implement: 5

The South Site is located on land contiguous to the existing tailings area (Figure 2). It is currently dry-land wheat and range ground. Topographically, the site lies on a finger of an alluvial fan that has its origin westward towards the Abajo Mountains. Overburden soils consist of approximately 50 feet of sandy clay pediment with some small gravels. Underlying geologic formations consist of 100 to 120 feet of Mancos Shale and Dakota/Burro Formation of unknown depth. The hydrogeologic regime of the site consists of well drained overburden soils with some perched lenses of water resting on the contact of the overburden and the Mancos shale, at least one zone of potentially perched water within the Mancos, and possibly some confined water in the upper portion of the Dakota/Burro Canyon Formation.

Hydrology at the site is simplified because no streams dissect the proposed repository. Archeologic resources are minimal. Aesthetically, the stabilized tailings would be approximately one and one-half miles from Monticello, and would be barely visible from the City. Institutionally, the site may be considered an "on-site" remedial action, thus allowing a waiver of all Federal, State and local permits under Superfund regulations. Although permits would not have to be applied for, the requirements and intent of the permits would be implemented. From a standpoint of available borrow materials, the site could be used to obtain all materials except sand, gravel and rock needed for filters and erosion protection. Transportation efforts would be minimized, as the site is within 1 mile of the tailings area and no more than 3 miles from all identified peripheral properties. Economically, the site is used for dry-land farming, and is privately owned. Ecologically, no known endangered species, flora or fauna, have been identified in the area. Climatically, the site is the same as the existing tailings piles, with an average annual precipitation of 18.3 inches.

Operating Unit I - Alternative 2 - Removal to a Licensed Repository

Capital Costs: $86,000,000

Operation/Maintenance Costs: $41,000

Present Worth: $70,000,000

Years to implement: 5

Relocation of the tailings and contaminated material from the Monticello site to an existing site licensed by the Nuclear Regulatory Commission is considered a viable option under Uranium Mill Tailings Remedial Action Project technical criteria. This alternative is feasible in the Monticello area, as the owners of the currently operating White Mesa Mill have expressed interest

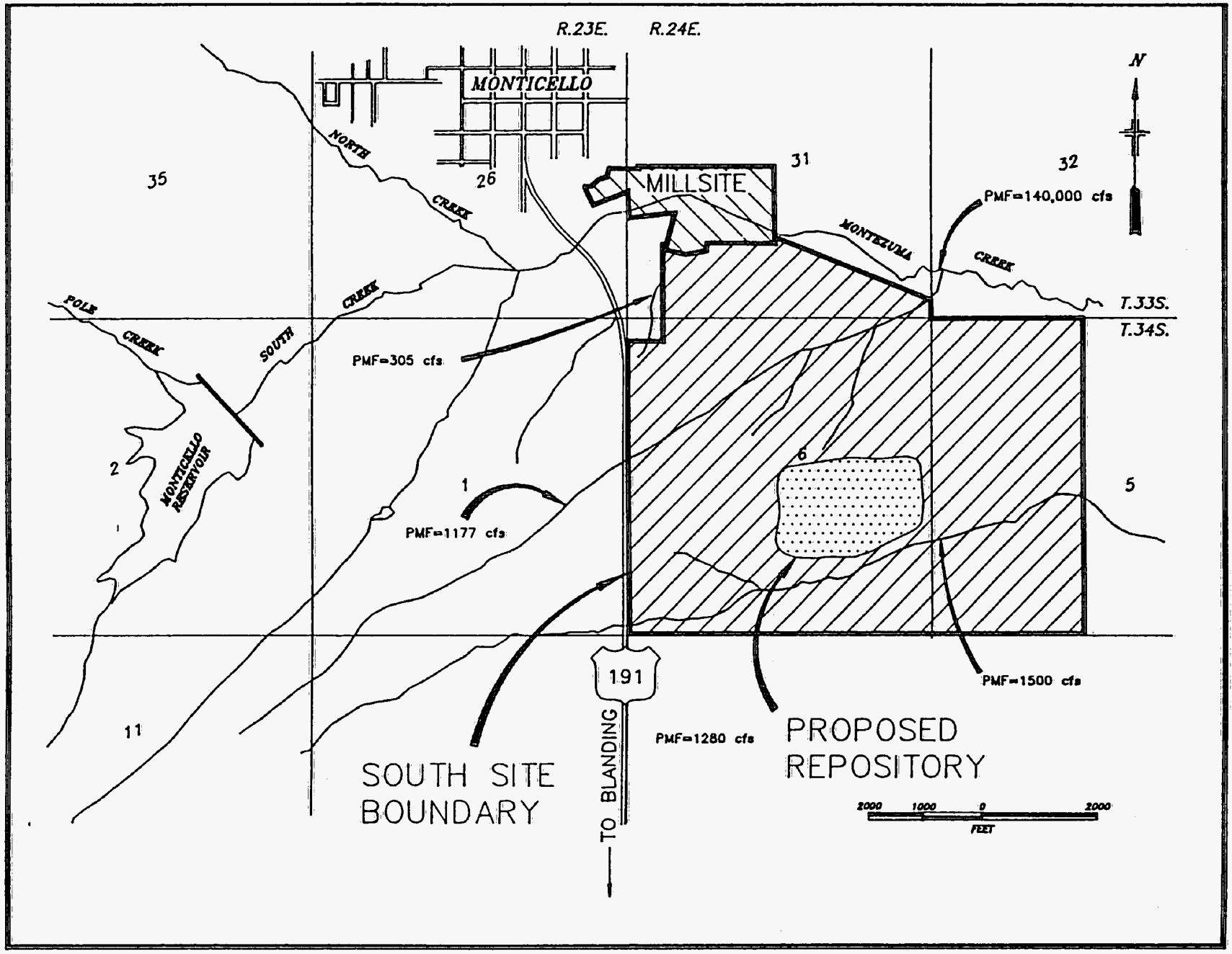

FIGURE 2. ON-SITE STABILIZATION SOUTH OF PRESENT SITE.

in providing a disposal site for the Monticello tailings. The following discussion is not intended to be an endorsement of the White Mesa facility over other private facilities, but is included for the purpose of comparing viable alternatives.

The White Mesa Mill is jointly owned by Energy Fuels Nuclear, Inc., and a wholly owned subsidiary of Union Carbide Corporation, Umetco Minerals Corporation (Umetco). Umetco is the operator of record. The White Mesa site is controlled by an active Nuclear Regulatory Commission Source Material License. The site is approximately 6 miles south of Blanding, Utah, and approximately 27 miles south of the Monticello site.

Disposal at the White Mesa site would be south of the existing tailings cells and would be a continuation of the present disposal system. The cell for the Monticello tailings would most likely be the southern most cell for the complete system.

The site is located on a broad mesa with deep canyons and washes on nearly all sides. Underlying geologic formations consist of Cretaceous Dakota/Burro Canyon formations with Jurassic Morrison formation underneath. Surface hydrology is simplified with no streams dissecting the site. The hydrogeologic regime of the site consists of well drained, shallow overburden soils with limited water available from the underlying Dakota formation. Movement of ground water occurring at shallow depths in the Dakota and Burro Canyon Formations is believed to be confined to isolated zones within White Mesa. Aesthetically, the tailings cell would lie in a gentle swale below the existing grade of nearby ridges. Borrow materials are available on site, with exception of riprap.

The State of Utah, through the Utah Bureau of Radiation Control has established a policy that no waste material carrying a Superfund designation can be accepted by a facility licensed as a uranium mill. This alternative would require concurrence from the Department of Energy, the Nuclear Regulatory Commission, the Environmental Protection Agency, and the State of Utah.

Operating Unit I - Alternative 3 - No Action

Capital Costs: $0

Operation/Maintenance Costs: $42,000 to $250,000

Present Worth: $1,700,000

Years to Implement: 0

The Superfund program requires that the "no action" alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, DOE would take no further action at the site to stabilize the tailings. However, continued environmental monitoring would be an annual Operation/ Maintenance activity.

EVALUATION OF OPERATING UNIT I ALTERNATIVES

The preferred alternative for cleaning up the tailings at the Monticello Millsite is Alternative 1 - On-site Stabilization South of Present Site. Based on current information, this alternative would appear to provide the best balance of trade-offs among the alternatives with respect to nine criteria that the Environmental Protection Agency uses to evaluate alternatives. Table 1 provides the performance of the preferred alternative against the nine criteria, noting how it compares to the other options under consideration. A glossary of the evaluation criteria is provided in Appendix B.

Table 1. Comparative Analysis of Alternatives, Operable Unit I

THRESHOLD CRITERIA

	Criterion No. 1 Overall Protection of Human Health and the Environment	Criterion No. 2 Compliance with Applicable or Relevant and Appropriate Requirements
Alternative 1: On-Site Stabilization South of Present Site	Stabilized tailings pile would be fenced and posted to prevent access and, therefore, prevent gamma exposure, and inadvertent human usage. Radon cap installed to prevent radon gas emissions. Multi-layered cover to protect radon cap from plants and animals would be constructed. Cover would also prevent wind and water erosion and minimize water infiltration. Tailings would be removed from direct contact with ground water. Tailings would be removed from Montezuma Creek floodplain.	All potential Applicable or Relevant and Appropriate Requirements would be complied with.
Alternative 2: Removal to a Licensed Repository	Removal of tailings to a licensed repository would protect human health and the environment in the same manner as Alternative 1.	All potential Applicable or Relevant and Appropriate Requirements would be complied with.
Alternative 3: No Action	Aquifer and Montezuma Creek would continue to be contaminated. Tailings subject to dispersal by wind and water. Human exposure to radioactive hazards would likely continue at present level.	Federal and State groundwater Applicable or Relevant and Appropriate Requirements would be violated. Uranium Mill Tailings Radiation Control Act Applicable or and Appropriate Requirements for radon gas emissions would be violated.

Table 1 (Continued) Comparative Analysis of Alternatives, Operable Unit I
PRIMARY BALANCING CRITERIA

	Criterion No. 3 Long-Term Effectiveness and Permanence	Criterion No. 4 Reduction of Toxicity, Mobility, or Volume Through Treatment
Alternative 1: On-Site Stabilization South of Present	Source of ground and surface water contamination is removed. Radon gas emissions are controlled. Reduces radiation dose commitment from millsite. Continued on-site and downgradient surface- and ground-water monitoring to verify design performance. Periodic maintenance required. Periodic containment integrity inspections required. Overall long-term health risks are reduced. Radiological risk is reduced by 40%. Non-radiological risk index of 0.09 indicates no adverse health effects.	Mobility of contaminants is reduced. No credit claimed for toxicity or volume reduction.
Alternative 2: Removal to a Licensed Repository	Source of ground- and surface-water contamination is removed. Radon gas emissions are controlled. Reduces radiation dose commitment from millsite. Continued on-site and downgradient surface and ground-water monitoring to verify design performance. Upon completion, Operation and Maintenance becomes responsibility of licensed repository operator. Overall long-term health risks are reduced. Radiological risk is reduced by 41%. Non-radiological risk was not calculated for removal to other locations.	Mobility of contaminants is reduced. No credit claimed for toxicity or volume reduction.
Alternative 3: No Action	Surface and ground-water contamination remains unchecked. Radon gas emissions continue uncontrolled. Millsite radiation dose commitment remains as is. Excessive long-term health risks to public and surveillance personnel. Radiological risk is 2.38×10^{-2} cancers per year above background. The non-radiological risk was not calculated.	No reduction in toxicity, mobility, or volume.

Table 1 (continued) Comparative Analysis of Alternatives, Operable Unit I

PRIMARY BALANCING CRITERIA

	Criterion No. 5 Short-Term Effectiveness	Criterion No. 6 Implementability
Alternative 1: On-Site Stabilization South of Present Site	Increased dust generation, dust suppressant would be applied. Thermoluminescent dosimeters would be required for workers. Air-monitoring apparatus required. Respiratory protection equipment may be required for workers. Response action protocol required in case of accidents. Slight increase in accident incidence rate projected. Very flexible to accommodate additional volume and/or a more stingent air quality standard. Radiological risk equals 1.76×10^{-2} cancer incidents per year. Non-radiological risk index is 0.47 which is below the 1.0 level of concern.	Conventional excavation technology and equipment can be utilized. Equipment and personnel availability is not a problem. If adjacent land can be acquired, public right-of-way would not be required. Performance of all activities on-site eliminates necessity for obtaining Federal, State, and local permits.
Alternative 2: Removal to a Licensed Repository	Increased dust generation dust suppressant would be applied. Thermoluminescent dosimeters would be required for workers. Air-monitoring apparatus required. Respiratory protection equipment may be be required for workers. Response action protocol required in case of accidents. Transport tailings to repository would increase road deterioration rate. Total accident rate projected to be 3-4 times that of Alternative 1 primarily due to trench haulage. Very flexible to accommodate additional volume and/or a more stingent air quality standard. Radiologic risk equals 1.47×10^{-2} cancer incidents per year. Non-radiologic risks were not calculated.	Conventional excavation technology and equipment can be utilized. Equipment and personnel availability is not a problem. Due to off-site activities (tailings transport), Federal, State, and local permits may be required. Existing repository license would require amendment and amended environmental assessment.
Alternative 3: No Action	No short-term effectiveness considerations.	Air and water quality monitoring required.

Table 1 (continued) Comparative Analysis of Alternatives, Operable Unit I, Primary Balancing Criteria

Criterion No. 7 Costs ($1,000)

Remedial Alternatives	Capital	Operation and Maintenance	Capital	Annual Operation/ Maintenance	Year	Present Worth of Capital & Operation & Maintenance 5% Discount Rate
Alternative 1	On-site Stabilization South of Present Site	Ground-water monitoring, and surveillance	52,100	41	1996-2020	42,302
Alternative 2	Removal to a Licensed Repository	Ground-water monitoring, and surveillance	86,400	41	1996-2020	69,874
Alternative 3	No Action	Environmental monitoring	0	250 42	1990-1996 1996-2020	1,702

Table 1 (continued) Comparative Analysis of Alternatives, Operable Unit I

MODIFYING CRITERIA

	Criterion No. 8 State Acceptance	Criterion No. 9 Community Acceptance
Alternative 1: On-Site Stabilization South of Present Site	Should be acceptable to State of Utah. Expected to meet Federal and State Applicable or Relevant and Appropriate Requirements. Would have positive economic benefits to community and state.	Elevated noise levels from heavy equipment operations during remedial action. Adverse visual impacts during construction. Following construction, revegetation, and reconstruction of creek would have positive long-term visual impact. Permanent repository will be contoured into existing terrain and be revegetated to minimize visual impact. Minimal population impact. Positive local employment and economic impact.
Alternative 2: Removal to a Licensed Repository	Increased traffic on Highway 191 may meet resistance. Locating all local tailings at a common repository may be viewed as advantageous; however, the State of Utah has adopted a policy which will not allow Superfund waste to be disposed of at a Nuclear Regulatory Commission licensed uranium mill.	Same considerations as Alternative 1 except permanent repository would not be in Monticello, thus eliminating its impact. Increased truck traffic on Highway 191 and associated increased in road wear are negative impacts. Community where licensed repository is located may have objections.
Alternative 3: No Action	The State of Utah, the Environmental Protection Agency, and the Department of Energy entered into the Federal Facilities Agreement with the expressed intent to clean up the Monticello site. It is, therefore, evident that "no action" is not acceptable to the State.	Not expected to gain community approval. However, some local residents do not believe the situation warrants expenditure of funds for such a cleanup. Note: Additional community issues will be evaluated after the public comments period ends and will be described in the Record of Decision for the site.

SUMMARY OF ALTERNATIVES FOR OPERATING UNIT II -- PERIPHERAL PROPERTIES

The alternatives analyzed for Operating Unit II are presented below. These are numbered to correspond with the numbers in the Remedial Investigation/Feasibility Study-Environmental Assessment reports.

- Alternative 1 -- Conventional Construction
- Alternative 2 -- Environmentally Sensitive Construction
- Alternative 3 -- Supplemental Standards
- Alternative 4 -- No Action

Peripheral properties encompass nearly 240 acres of private and public property adjacent to the millsite. These properties include former ore buying stations and areas contaminated by wind-blown and waterborne migration of tailings. The total volume of contaminated soil associated with the peripheral properties is over 300,000 cubic yards.

By definition, the peripheral properties must be titled as vicinity properties because they are not the property of the Department of Energy. However, these properties are large in nature, and if remediated, they would be part of the millsite remediation as the final layer of the repository prior to capping. Compared to the millsite tailings, the contaminated soil of peripheral properties is relatively clean (averaging less than 8 percent of the millsite tailings Ra-226 concentration) and thus would enhance the radon cap performance.

It is important to understand that the presentation which follows on alternatives for peripheral properties is not a discussion of whether or not the peripheral properties should be cleaned up. The Department of Energy has already made a Record of Decision (September, 1989) that all vicinity properties, including those defined as peripheral properties, will be cleaned up to the Environmental Protection Agency standards as described in 40 Code of Federal Regulations 192. Thus, the intent of this section of the Proposed Plan is to describe the construction alternatives for remedial action on the peripheral properties and the impacts of those alternatives. Under all alternatives, remedial action would occur in one to two years. Costs for remedial action are presented in Table 2.

Delineation of Peripheral Properties

Contaminated peripheral properties are divided into the following eleven separate land types.

- A Mesa Irrigated Pasture
- B Hillside Dense Vegetation
- B-SS Hillside Dense Vegetation Supplemental Standards
- C Hillside Low Vegetation
- D Hilltop Dryland Pasture
- E Creek Bottom Pasture
- F-SS Monticello Cemetery
- G BLM Compound
- H Upper Montezuma Creek Bank
- H-SS Upper Montezuma Creekbed
- I-SS Lower Montezuma Creek

OPERATING UNIT II - Alternative 1 -- Conventional Construction

This type of remedial action could be used on all eleven types of peripheral properties. It involves the use of large earthmoving equipment to clean the land and remove the contaminated soil. Soil removed would be replaced with clean material and the site revegetated. Although all means would be attempted to revegetate the area to its present condition, it would take several years to re-establish the native brushes and decades to re-establish the native tree species.

OPERATING UNIT II - Alternative 2 -- Environmentally Sensitive Construction

In areas with mature dense vegetation (Land Types B, B-SS) hand excavation could be used successfully to remove the contaminated soils, yet minimize environmental damage to these areas which are important wildlife habitats. An option to hand excavation would be the use of high suction vacuum equipment specifically designed for cleaning up hazardous waste spills. This equipment has similar costs to hand excavation yet would tend to clean up more precisely the actual areas of contamination. For the Montezuma Creek Canyon area (Land Types H-SS, and I-SS) contaminated soil would be removed by a combination of heavy equipment and hand excavation. During remedial action the creek flow would be diverted by pumping around the construction area to minimize sediment transport. To re-establish the creek bottom ecosystem, the channel would be revegetated with native wetland species, revetments added to prevent bank erosion, and the stream bottom modified with rock riffle/pool structures to enhance aquatic habitat.

OPERATING UNIT II - Alternative 3 -- Supplemental Standards

Regulations in 40 Code of Federal Regulations 192.92 as well as the Department of Energy guidelines provide for the usage of supplemental standards in areas where remedial action would cause undue environmental damage or costs of remedial action would be unreasonably high in comparison to the derived environmental and health benefits. The State, the Environmental Protection Agency, and the Department of Energy would use this criteria on a case by case basis where it was evident that the impact of remediation far exceeds the benefits. Prior to implementing Supplemental Standards for any area during the remedial design/remedial action, a detailed report will be prepared for Environmental Protection Agency and State of Utah concurrence which gives special consideration to the overall protection of human health and the environment.

Areas where supplemental standards could be appropriate include land types described as hillside dense vegetation (B-SS), the Monticello Cemetery (F-SS), Upper Montezuma Creek (H-SS), and Lower Montezuma Creek (I-SS).

OPERATING UNIT II - Alternative 4 -- No Action

Although the Department of Energy has already made a Record of Decision to clean up all peripheral properties (vicinity properties) to Environmental Protection Agency Standards, the no-action alternative is reviewed to demonstrate what the baseline conditions would be without any remedial action.

Evaluation of Operable Unit II - Alternatives

Proposed remedial action methods for Operable Unit II will depend on the degree of contamination and the environmental consequences associated with remediating specific land types. The proposed action consists of a combination of supplemental standards application, removal by environmentally-sensitive construction practices, and removal by conventional construction techniques.

Environmentally sensitive construction techniques will be used on peripheral properties having dense natural vegetative cover (B and B-SS). Hand excavation, and possibly high-suction vacuum equipment, will be used to remove contaminated soils in important wildlife habitat areas.

Where necessary, conventional construction techniques will be used to remove contaminated soil from specific areas, including those previously disturbed, such as farm land. On several properties, a combination of conventional and environmentally-sensitive construction techniques will be used.

Supplemental standards, which allow leaving contamination in place as identified in 40 Code of Federal Regulations Part 192.22, will be applied to areas where remedial action would cause undue environmental damage, or where remediation costs would be unreasonably high in comparison to the derived environmental and health benefits. These areas would include the Monticello Cemetery (F-SS) and Upper and Lower Montezuma Creek (H-SS and I-SS).

Table 2 profiles the performance of the preferred alternative against the nine evaluation criteria.

Table 2. Comparative Analysis of Alternatives, Operable Unit II

THRESHOLD CRITERIA

	Criterion No. 1 Overall Protection of Human Health and the Environment	Criterion No. 2 Compliance with Applicable or Relevant and Appropriate Requirements
Alternative 1: Conventional Construction	Removal of contaminated soil would eliminate further human and environmental exposure. Construction activities would cause severe environmental damage to land types B, B-SS, H-SS, and I-SS.	In compliance with 40 Code of Federal Regulations 192. For upper and lower Montezuma Creek areas (H-SS and I-SS) location-specific Applicable or Relevant and Appropriate Requirements could be difficult to achieve.
Alternative 2: Environmentally Sensitive Construction	Contaminated soil is removed. Hand labor and/or special equipment and specific restoration efforts would minimize negative environmental impact.	In compliance with 40 Code of Federal Regulations 192. For upper and lower Montezuma Creek areas (H-SS and I-SS) location-specific Applicable or Relevant and Appropriate Requirements can be met by using environmentally sensitive construction techniques.
Alternative 3: Supplemental Standards	Dependent upon future human activities in the area, although areas considered for supplemental standards are of such terrain as to discourage human activity.	In compliance with 40 Code of Federal Regulations 192 and location-specific Applicable or Relevant and Appropriate Requirements.
Alternative 4: No Action	Would result in continued exposure of man and the environment to elevated levels of radiologic contamination.	"No action" would not comply with 40 Code of Federal Regulations 192.

Table 2 (continued) Comparative Analysis of Alternatives, Operable Unit II

PRIMARY BALANCING CRITERIA

	Criterion No. 3 Long-Term Effectiveness and Permanence	Criterion No. 4 Reduction of Toxicity, Mobility, or Volume Through Treatment
Alternative 1: Conventional Construction	Effective permanent solution. Long-term radiologic risk assumed to be background. Non-radiologic risk is included in Operable Unit I, Alternative 1.	Contaminants are immobilized.
Alternative 2: Environmentally Sensitive Construction	Effective permanent solution. Long-term radiologic risk assumed to be background. Non-radiologic risk is included in Operable Unit I, Alternative 1.	Contaminants are immobilized.
Alternative 3: Supplemental Standards	Effectiveness depends upon future developmental activity. Most likely effective and permanent. Tendency for contaminant migration to continue via wind and water transport. Total long-term radiation dose are within 1% of guidelines.	A minimum of 88% of contaminants associated with peripheral properties would be removed and immobilized.
Alternative 4: No Action	Neither effective nor permanent. Long-term radiologic risk is 2.38×10^{-2} cancer incidents per year. Non-radiologic risk was not calculated.	No reduction of toxicity, mobility, or volume.

Table 2. (continued) Comparative Analysis of Alternatives, Operable Unit II

PRIMARY BALANCING CRITERIA

	Criterion No. 5 Short-Term Effectiveness	Criterion No. 6 Implementability
Alternative 1: Conventional Construction	Increased dust generation, dust suppressants would be applied. Thermoluminescent dosimeters would be required for workers due to possible increased radiation exposures. Exceptionally flexible on a case-by-case basis. Radiologic risk for all construction techniques equals 2.76 x 10^{-3} cancer incidents per year. Non-radiologic risks are included in Operable Unit I, Alternative 1.	Conventional construction equipment can be utilized. Equipment and personnel readily available.
Alternative 2: Environmentally Sensitive Construction	Dust generation to lesser degree than Alternative 1. More workers required to accomplish task in same time as Alternative 1, thereby increasing number of people subject to increased exposure risk. Exceptionally flexible on a case-by-case basis. Radiologic risk for all construction techniques equals 2.76 x 10^{-3} cancer incidents per year. Non-radiologic risks are included in Operable Unit I, Alternative 1.	Hand-operated digging equipment and other specialized equipment easily applied and available personnel readily available.
Alternative 3: Supplemental Standards	No short-term effectiveness considerations. Exceptionally flexible on a case-by-case basis.	Administrative feasibility concerns exist in application of supplemental standards.
Alternative 4: No Action	No short-term effectiveness considerations.	Air and water quality monitoring required.

Table 2. (continued) COMPARATIVE ANALYSIS OF ALTERNATIVES, OPERABLE UNIT II

PRIMARY BALANCING CRITERIA

Criterion No. 7 Costs

SYMBOL	LAND TYPE	CONTAMINATION QUANTITIES		REMEDIAL ACTION COSTS				APPLICABILITY OF SUPPLEMENTAL STANDARDS
				CONVENTIONAL CONSTRUCTION COST		ENVIRONMENTALLY SENSITIVE CONSTRUCTION COST		
		AREA (acres)	VOLUME (cu.yd.)	per cu.yd.	total	per cu.yd.	total	
A	Mesa Irrigated Pasture	20	16,360	$29.30	$480,000			NOT APPLICABLE (No environmental damage)
B	Hillside Dense Vegetation	22	33,120	$46.20	$1,530,000	$141.30	$4,680,000	NOT APPLICABLE (High Ra226 concentrations)
B-SS	Hill. Dense Veg. S.S. area	29	24,800	$56.90	$1,410,000	$144.50	$3,580,000	APPLICABLE (Low Ra226 conc., High remedial action cost, Env. damage.)
C	Hillside Low Vegetation	37	55,550	$45.20	$2,510,000	-	-	NOT APPLICABLE (High Ra226 concentrations)
D	Hilltop Dryland Pasture	44	70,800	$38.80	$2,750,000	-	-	NOT APPLICABLE (High Ra226 concentrations)
E	Creek Bottom Pasture	59	95,230	$37.80	$3,600,000	-	-	NOT APPLICABLE (High Ra226 concentrations)
F-SS	Monticello Cemetery	3	2,000	$70.00	$140,000	-	-	APPLICABLE (Low Ra226 conc., High remedial action cost, Env. damage.)
G	BLM Compound	4	7,070	$70.70	$500,000	-	-	NOT APPLICABLE (High Ra226 concentrations)
H	Upper Montezuma Creek Bank	5	6,670	$33.00	$220,000	-	-	NOT APPLICABLE (High Ra226 concentrations)
H-SS	Upp. Mont. Creekbed	2	1,800	$44.40	$80,000	$200.00	$360,000	APPLICABLE (High remedial action cost, Env. damage.)
I-SS	Lower Montezuma Creek	14	10,000	$69.00	$690,000	$118.00	$1,180,000	APPLICABLE (High remedial action cost, Env. damage, Archeological damage.)
	TOTAL AREA	239 Acres						
	TOTAL VOLUME	323,400 Cu.Yd.						

Table 2 (continued) Comparative Analysis of Alternatives, Operable Unit II

MODIFYING CRITERIA

	Criterion No. 8 State Acceptance	Criterion No. 9 Community Acceptance
Alternative 1: Conventional Construction	Preliminary assessment - supportive, will be clarified after State review of Remedial Investigation/Feasibility Study.	Probable concern with visual impact on environmentally sensitive areas. Habitat disruption would be a major concern.
Alternative 2: Environmentally Sensitive Construction	Preliminary assessment - supportive, will be clarified after State review of Remedial Investigation/Feasibility Study.	Expected to be supportive.
Alternative 3: Supplemental Standards	Position presently unknown, will be clarified after State review of Remedial Investigation/Feasibility Study.	Position presently unknown, will be clarified after Remedial Investigation/ Feasibility Study.
Alternative 4: No Action	Assumed to be unaccepted since State is in support of peripheral properties cleanup.	Overall considered to be unacceptable.

SUMMARY OF ALTERNATIVES FOR OPERATING UNIT III -- GROUNDWATER

The alternatives analyzed for OU III are presented below. These are numbered to correspond with the numbers in the Remedial Investigation/Feasibility Study-Environmental Assessment Report.

- Alternative 1 -- Active Ground-Water Collection, Treatment, and Discharge.
- Alternative 2 -- Active Ground-Water Collection and Evaporation
- Passive Restoration with Institutional Controls
- Alternative 4 -- No Action

Common Elements. All alternative would be implemented after an Operable Unit I alternative removed the source of the ground-water contamination (the tailings). Both active alternatives would collect the contaminated groundwater in a series of interceptor drains and pump the water to a central location for treatment. No other common elements exist for the alternatives.

OPERABLE UNIT III - Alternative 1 -- Active Ground-Water Collection, Treatment, and Discharge

Capital Cost: $5,700,000

Operation/Maintenance Costs: $250,000 to $261,000

Present Worth: $6,400,000

Years to Implement: 13

Once the contaminated groundwater is collected it would undergo treatment in three stages: pre-treatment, reverse osmosis treatment, and post-treatment. The reverse osmosis treatment process was tentatively selected to remove the contaminants from the ground water because of its success in similar applications. The process would require pretreatment consisting of turbidity and suspended solids removal in a linear presedimentation pond; pH control using sodium hexametaphosphate to keep calcium, magnesium, and metallic salts in solution and prevent precipitation which would plug the membranes; and aeration and filtration of the influent to oxidize the iron and manganese to insoluble forms which would be removed by a rapid sand filter.

The reverse osmosis treatment process would consist of high pressure pumps forcing the water through a semi-permeable membrane from a more concentrated solution to a less concentrated solution. Inorganics like uranium and radium salts and organics are rejected and only water passes through the pores. The performance of a reverse osmosis membrane is measured by the recovery or conversion rate. A recovery rate for the 30,000 gallons per day treatment plant was assumed at 70 percent. At this rate, 21,000 gallons per day of product (effluent to discharge) and 30 percent or 9,000 gallons per day of brine would be produced.

While the effluent from the plant could be discharged to Montezuma Creek following a post-treatment pH adjustment, the concentrate or waste flow requires additional post-treatment.

The post-treatment of the waste flow would consist of discharge to a lined evaporation pond. The sludge would be allowed to dry and eventually would require removal to a disposal site licensed to accept these materials. 3.3 million gallons of brine would be produced each year which would contain 124 dry tons of solids.

During the clean-up time period estimated to be 13 years, ground-water monitoring would take place along with discharge monitoring of the treatment plant effluent. For this alternative, weekly sampling of the influent and effluent is assumed.

OPERATING UNIT III - Alternative 2 -- Active Ground-Water Collection and Evaporation

Capital Cost: $7,600,000

Operation/Maintenance Costs: $56,000 to $250,000

Present Worth: $6,000,000

Years to Implement: 13

Collected groundwater would be pumped to a treatment pond for evaporation. The evaporation pond would be lined to prevent recontamination of the ground water and would be sized to evaporate 11 million gallons annually or 30,000 gallons per day. The surface area of the pond required is approximately 13 acres, which is based on the volume to be evaporated using the net annual evaporation loss estimated at 31 inches per year. In addition, the pond would be sized to handle the sludge produced over its 13-year operating period. Approximately 139 dry tons of solids would be produced each year that would require drying and final disposal at a licensed facility.

OPERATING UNIT III - Alternative 3 -- Passive Restoration with Institutional Controls

Capital Costs: $188,000

Operation/Maintenance Costs: $42,000 to $250,000

Present Worth: $1,900,000

Years to Implement: 60

The Environmental Protection Agency issued proposed regulations in September 1987 under 40 Code of Federal Regulations 192 to remediate and prevent contamination of ground water at inactive uranium mill tailing sites. As part of the general standards for remediation of contaminated ground water, the Environmental Protection Agency proposed the utilization of "institutional controls" to prevent use of contaminated ground water under certain limited circumstances. For aquifers where passive restoration of the contaminated

ground water is projected to occur within 100 years and where the ground water is not now used and is not projected to be used for a public water supply during that period, active remediation may be avoided if there are satisfactory institutional controls which will effectively protect public health and satisfy beneficial uses of ground water. Acceptable institutional controls include legal use restrictions enforceable by permanent government entities or other measures with a high degree of permanence, such as Federal or State ownership of the land containing the contaminated water. While there is a broad range of potential institutional controls, this alternative would focus solely on controls derived from statutory or regulatory authorities and not on controls which do not rely on legal authority for their efficacy, such as markers, fences, or distribution of health advisories.

Passive restoration with institutional controls would be implemented after an Operable Unit I alternative removed the source of the ground-water contamination, the tailings. Because the ground-water system is characterized by flushing of the alluvial aquifer, cleansing of the affected ground water would ensue. The contaminant transport modeling performed in the Remedial Investigation indicates that the shallow alluvial aquifer would improve to background quality within 60 years, which is within compliance of the proposed Uranium Mill Tailings Remedial Action ground-water regulations of 100 years.

OPERATING UNIT III - Alternative 4 -- No Action

Capital Costs: $0

Operation/Maintenance Costs: $42,000 to $250,000

Present Worth: $1,700,000

Time to Implement: 60

The no-action alternative has been considered and provides a baseline within which to compare the other alternatives. After removal of the source (tailings), the alluvial aquifer would remain contaminated for a period of approximately 60 years. The no-action alternative would require 60 years of restricted use of the on-site and off-site areas, because exposure could increase significantly if land use were to change or uncontrolled removal of the ground water were to occur. Failure to perform institutional controls on the alluvial aquifer would result in noncompliance with the draft Uranium Mill Tailings Remedial Action ground-water regulations, a potential Applicable or Relevant and Appropriate Requirement. The potential for human exposure to radioactive elements by ingestion of ground water contaminated by the tailings would remain.

Evaluation of Operating Unit III Alternatives

The preferred alternative for clean-up of the ground-water contamination is Alternative 3 -- Passive Restoration with Institutional Controls. Based on current information, this alternative would appear to provide the best balance of trade-offs among the alternatives with respect to nine criteria that the Environmental Protection Agency uses to evaluate alternatives. Table 3 profiles the performance of the preferred alternatives against the nine criteria noting how it compares to the other options under consideration.

Table 3. Comparative Analysis of Alternatives, Operable Unit III

THRESHOLD CRITERIA

	Criterion No. 1 Overall Protection of Human Health and the Environment	Criterion No. 2 Compliance with Applicable or Relevant and Appropriate Requirements
Alternative 1: Active Ground-Water Collection, Treatment, and Discharge	Ground water can be used without restiction after remedial action is complete (13 years). Residual waste left over from the treatment process must be transported to a licensed disposal facility. Institutional controls required during remediation process. Underlying assumption is that the source of contamination is removed by other remedial action (Operable Unit I).	Satisfies Applicable or Relevant and Appropriate Requirements.
Alternative 2: Active Ground-Water Collection and Evaporation	Active ground-water collection and evaporation would protect human health and the environment in the same manner as Alternative 1.	Satisfies Applicable or Relevant and Appropriate Requirements.
Alternative 3: Passive Restoration with Institutional Controls	Public health protected by institutional controls. Environmental protection accomplished gradually over the 60 year implementation period. Afterward, unrestricted ground-water usage.	Satisfies Applicable or Relevant and Appropriate Requirements.
Alternative 4: No Action	Lack of institutional controls could allow human exposure during 60-year passive restoration period.	Does not satisfy all Applicable or Relevant and Appropriate Requirements.

Table 3 (continued) Comparative Analysis of Alternatives, Operable Unit III

PRIMARY BALANCING CRITERIA

	Criterion No. 3 Long-Term Effectiveness and Permanence	Criterion No. 4 Reduction of Toxicity, Mobility, or Volume Through Treatment
Alternative 1: Active Ground-Water Collection, Treatment, and Discharge	Ground-water cleanup is permanent (assumes contamination source has been removed by other remedial action). Treatment residuals must be disposed of at a licensed facility. Long term maintenance required at disposal facility. Thirteen year implementation period. Radiologic risk equals 4.90×10^{-5} over lifetime. The cumulative non-radiologic risk index equals 6.2.	Toxicity, mobility, and volume of contaminated media would be reduced.
Alternative 2: Active Ground-Water Collection and Evaporation	Long-term effectiveness and permanence considerations same as Alternative 1. Radiologic risk equals 4.9×10^{-5} over lifetime. The cumulative non-radiologic risk index equals 6.2.	Toxicity, mobility, and volume of contaminated media would be reduced.
Alternative 3: Passive Restoration with Institutional Controls	Treatment is permanent after an 60 year implementation period. No treatment residuals to be disposed of. Radiologic risk equals 4.70×10^{-5} over lifetime. The cumulative non-radiologic risk index equals 5.2.	Toxicity reduced over time. Institutional controls help reduce mobility. Volume reduced over time.
Alternative 4: No Action	Same as Alternative 3. Risk of unauthorized ground-water usage prior to completion of passive restoration. Radiologic risk equals 1.60×10^{-4} over lifetime. The cumulative non-radiologic risk index equals 85 which indicates a significant health concern.	Toxicity reduced over time. Volume reduced over time. No reduction in mobility until passive restoration is complete.

Table 3 (continued) Comparative Analysis of Alternatives, Operable Unit III

PRIMARY BALANCING CRITERIA

	Criterion No. 5 Short-Term Effectiveness	Criterion No. 6 Implementability
Alternative 1: Active Ground-Water Collection, Treatment, and Discharge	System installation and operation not expected to pose risk. Periodic collection and transport of evaporation residuals may produce increase in risk to workers. Thirteen-year remedial action implementation period. Flexibility to changes in flow, concentration, and duration of cleanup can be designed into the treatment system. Radiologic occupational risk equals 9.4×10^{-4}. Non-radiologic risk equals 0.	Technology well established. Performance well documented. Comparatively large number of mechanical components with associated reliability concerns. Overall reliability high. Equipment and services readily available. Consumes 10 acre-feet/year of water which may require further administrative requirements. Thirteen-year implementation period.
Alternative 2: Active Ground-Water Collection and Evaporation	Short-term effectiveness considerations same as Alternative 1. Flexibility changes in flow, concentration, and duration of cleanup can be designed into the treatment system. Radiologic occupational risk equals 1.1×10^{-3}. Non-radiologic risk equals 0.	Technology and performance well established. Comparatively small number of mechanical components promotes reliability. Equipment and services readily available. Consumes 34 acre-feet/year of water which may require further administrative requirements. Thirteen-year implementation period
Alternative 3: Passive Restoration with Institutional Controls	Minimal risks to workers and community. Institutional controls required for 60-year implementation period. Length of implementation period increases risk of unauthorized ground-water usage. Radiologic occupational risk equals background (8.5×10^{-4}). Non-radiologic risk equals 0.	Requires implementation of institutional controls only. Such controls are available. Does not consume water; however, water is precluded from use for length of implementation period (60 years).
Alternative 4: No Action	No short-term effectiveness considerations associated with the no-action alternative.	Continued ground-water quality monitoring.

Table 3 (continued) Comparative Analysis of Alternatives, Operable Unit III

PRIMARY BALANCING CRITERIA

Criterion No. 7 Costs

Description			1989 Dollars Cost Estimates			Present Worth of Capital & Operation/Maintenance Costs
Remedial Alternatives	Capital	Operation and Maintenance	Capital	Annual Operation & Maintenance	Year	5% Discount Rate
Alternative 1:	Ground-Water Collection, Treatment, and Discharge	Ground-water pumping, treatment, and discharge, environmental monitoring, and water augmentation	$5,716,000	$250,000 $261,000	1990-1996 1996-2009	$6,378,000
Alternative 2:	Active Ground-Water Collection and Evaporation	Ground-water pumping, evaporation, environmental monitoring, and water augmentation	7,593,000	$250,000 $ 56,000	1990-1996 1996-2009	$5,962,000
Alternative 3:	Passive Restoration with Institutional Controls	Environmental monitoring and water augmentation	188,000	$250,000 42,000	1990-1996 1996-2020	$1,864,000
Alternative 4:	No Action	Environmental monitoring	0	250,000 42,000	1990-1996 1996-2020	$1,702,000

Table 3 (continued) Comparative Analysis of Alternatives, Operable Unit III

MODIFYING CRITERIA

	Criterion No. 8 State Acceptance	Criterion No. 9 Community Acceptance
Alternative 1: Active Ground-Water Collection, Treatment, and Discharge	Position of State not presently known. State input expected following State review of Remedial Investigation/Feasibility Study.	Community preference unknown at present time.
Alternative 2: Active Ground-Water Collection and Evaporation	Position of State not presently known. State input expected following State review of Remedial Investigation/Feasibility Study.	Community preference unknown at present time.
Alternative 3: Passive Restoration with Institutional Controls	Position of State not presently known. State input expected following State review of Remedial Investigation/Feasibility Study.	Community preference unknown of present time.
Alternative 4: No Action	Acceptance unlikely.	Community preference unknown at present time.

SUMMARY OF PREFERRED ALTERNATIVES

In summary, the implementation of the preferred alternatives for tailing removal to the south site, various approaches for peripheral property clean-up, and ground water passive restoration with institutional controls is believed to provide the best balance of trade-offs among alternatives with respect to the evaluation criteria.

Based on the information available at this time, therefore, the Department of Energy, the Environmental Protection Agency, and the State of Utah believe the preferred plan would be protective of human health and the environment, would meet Federal and State standards, would be cost effective, and would provide a permanent solution.

COMMUNITY INVOLVEMENT

The Proposed Plan is a public participation decision document and, as such, the public should avail themselves of this opportunity to comment to DOE, EPA, and the State of Utah. Public comment on the Proposed Plan will be for 30 days beginning _____ and extending through _____. All written comments should be sent to:

Mr. Pete Mygatt, Public Affairs Specialists
U.S. Department of Energy
P.O. Box 2567
Grand Junction, Colorado 81502
(303)248-6015 (collect calls will be accepted)

Written or verbal comments may also be made at a public hearing scheduled for 7 p.m. _____ at the San Juan County Courthouse in Monticello, Utah.

Additional questions may be referred to:

Mr. Robert McLeod
State of Utah
Department of Health
288 North 1460 West
P.O. Box 16690
Salt Lake City, Utah
(801)538-6170

Mr. Lam Nguyen
U.S. Environmental Protection Agency
999 18th Street, Suite 500
Denver, Colorado 80202-2405
(303)293-1793

The Department of Energy, the Environmental Protection Agency, and the State of Utah solicits input from the community on the cleanup methods proposed for each Superfund response action. Comments will be summarized and responses provided in the Responsiveness Summary section of the Record of Decision. The Record of Decision is the document that, after consultation with the Environmental Protection Agency and the State of Utah, presents the Department of Energy's final selection for clean-up.

APPENDIX A

EPA STANDARDS

In Demcember 1982, the Environmental Protection Agency issued a Final Environmental Impact Statement which evaluated standards for cleanup and long term control of uranium mill tailings at inactive millsites that qualify for remedial action under the Uranium Mill Tailings Radiation Control Act.

The standards were issued to reduce and control the hazards associated with uranium mill tailings. This includes remedial action to clean up tailings that have spread from the original site or have been removed for use elsewhere. Although the Monticello Millsite is located on federal government property and not subject to Uranium Mill Tailings Radiation Control Act, the standards promulgated to implement that legislation are appropriate for remediation of the vicinity properties.

Extent of contamination is based on the criteria set by Environmental Protection Agency Standards in 40 Code of Federal Regulations, which are as follows:

192.02 Standards for Stabilization of Tailings Piles

Control shall be designed[a] to:

(a) be effective for up to one thousand years, to the extent reasonably achievable, and, in any case, for at least 200 years, and,

(b) provide reasonable assurance that releases of radon-222 from residual radioactive material to the atmosphere will not --

(1) exceed an average [b] release rate of 20 picocuries per square meter per second, or

(2) increase the annual average concentration of radon-222 in air at or above any location outside the disposal site by more than one-half picocurie per liter.

Notes:

[a]Because the standard applies to design, monitoring after disposal is not required to demonstrate compliance.

[b]This average shall apply over the entire surface of the disposal site and over at least a one-year period. Radon will come from both residual radioactive materials and from materials covering them. Radon emissions from the covering materials should be estimated as part of developing a remedial action plan for each site. The standard, however, applies only to emissions from residual radioactive materials to the atmosphere.

192.12 Standards for Soil Contamination

Remedial action shall be conducted so as to provide reasonable assurance that, as a result of residual radioactive materials from any designated processing site,

(a) the concentration of radium-226 in land averaged over any area of 100 square meters shall not exceed the background level by more than --

(1) 5 pCi/g, averaged over the first 15 cm of soil below the surface, and

(2) 15 pCi/g, averaged over 15 cm thick layers of soil more than 15 cm below the surface.

(b) in any occupied or habitable building --

(1) the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 working levels. In any case, the radon decay product concentration (including background) shall not exceed 0.03 working levels, and

(2) the level of gamma radiation shall not exceed the background level by more than 20 microroentgens per hour.

During 1984 radiologic characterizations, a background level of 1.0 pCi/g Ra-226 was established for the Monticello, Utah area. Therefore, soils with Ra-226 concentrations above 6 pCi/g Ra-226 in the 0 to 6 inch (15cm) layer and 16 pCi/g in the subsequent 6-inch (15cm) layers below 6 inches (15cm) are considered to be contaminated and eligible for remedial action.

192.21 Criteria for Applying Supplemental Standards

The implementing agencies may apply standards in lieu of the standards of Subparts A or B if certain circumstances exist, as defined in 192.21.

192.22 Supplemental Standards

"Federal agencies implementing Subparts A and B may in lieu thereof proceed pursuant to this section with respect to generic or individual situations meeting the eligibility requirements of 192.21."

(a) "...the implementing agencies shall select and perform remedial actions that come as close to meeting the otherwise applicable standards as is reasonable under the circumstances."

(b) "...remedial actions shall, in addition to satisfying the standards of Subparts A and B, reduce other residual radioactivity to levels that are as low as is reasonably achievable."

(c) "The implementing agencies may make general determinations concerning remedial actions under this Section that will apply to all locations with specified characteristics, or they may make a determination for a specific location, the Department of Energy shall inform any private owners and occupants of the affected location and solicity their comments. The Department of Energy shall provide any such comments to the other implementing agencies [and] shall also periodically inform the Environmental Protection Agency of both general and individual determination under the provisions of this section."

DEPARTMENT OF ENERGY - HOT SPOT CRITERIA

As of 19 October 1987, the Department of Energy started applying the hot-spot guideline for clean-up of vicinity properties as outlined by the U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites [Revision 2 March 1987]. These guidelines read as follows:

1. The method for determining Hot Spot Limits, which is based on the 100 mrem/year Dose Limit, as described in the Formerly Utilized Sites Remedial Action Program procedures manual, shall still be applicable for determining allowable concentrations of radionuclides under inhomogeneous soil contamination conditions. However, the following approach, more appropriate for field applications, may be used in place of the Dose Limit method and is recommended for general applications.

2. For the alternative approach, the basic Hot Spot Limits will be calculated for each specific site as follows:

   $Shg = Sg * (100\ m^2/A)^{1/2}$

   where, Shg = the Hot Spot Limit (pCi/gram)
   Sg = the Authorized Limit for a specific site (pCi/gram)
   A = the area of the hot spot in square meters
   $(100/A)^{1/2}$ is the hot spot multiplication factor.

3. The limits shall be applied in the field over ranges of area with the factors being constant over a given area. The ranges and factors to be used are indicated below:

Range	Factor (Multiple of Authorized Limit)
$<1\ m^2$	10*
$1 - <3\ m^2$	6
$3 - <10\ m^2$	3
$10 - 25\ m^2$	2

*Areas less than one square meter are to be averaged over the one square meter and that average shall not exceed ten times the Authorized Limit.

4. The average Authorized Limit is considered adequate to protect the public for areas larger than 25 square meters; hence, no special Hot Spot Limits are required for areas larger than 25 square meters.

5. Averaging of hot spots less than or equal to 25 square meters shall be done only over the local hot spot area.

6. Every reasonable effort shall be made to identify and remove any source which has a concentration of a radionuclide exceeding 30 times the Authorized Limit irrespective of area.

Table A-1 Uranium Mill Tailings Radiation Control Act of 1978
Ground-Water Standards[1] 40 CFR 192

Maximum Concentration of Constituents for Ground-Water Protection

Constituent	Maximum concentration mg/l
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Molybdenum[2]	0.1
Silver	0.05
Nitrate as N[2]	10.0
Endrin (1,2,3,4,10,10-hexachloro-1,7-epoxy-1,4,4a,5,6,7,8,9a-octahydro-1, 4-endo, endo-5.8-dimethano naphthalene)	0.0002
Lindane (1,2,3,4,5,6-hexachlorocyclohexane, gamma isomer)	0.004
Methoxychlor (1,1,1,-Trichloro-2,2-bis (p-methoxyphenylethane)	0.1
Toxaphene ($C_{10}H_{10}Cl_4$ Technical chlorinated camphene, 67-69 percent chlorine)	0.0005
2,4-D (2,4 Dichlorophenoxyacetic acid)	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid)	0.01
	pCi/liter
Combined radium-226 and radium-228[2]	5
Combined uranium 234 and uranium 238[2]	30
Gross alpha-particle activity (excluding[2] radon and uranium)	15

[1]40 CFR 192; Revised 7/1/86.
[2]40 CFR 192; Proposed 9/24/87.

APPENDIX B

Glossary of Evaluation Criteria

- **Overall Protection of Human Health and Environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering controls or institutional controls.

- **Compliance with Applicable or Relevant and Appropriate Requirements** addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

- **Long-term effectiveness and permanence** refers to the magnitude of residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- **Reduction of toxicity, mobility, or volume through treatment** is the anticipated performance of the treatment technologies that may be employed in a remedy.

- **Short-term effectiveness** refers to the speed with which the remedy achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- **Implementability** is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

- **Cost** includes capital, operation and maintenance costs, and present worth analysis.

- **State acceptance** indicates whether, based on its review of the Remedial Investigation/Feasibility Study and Proposed Plan, the State concurs with, opposes, or has no comment on the preferred alternative.

- **Community acceptance** will be assessed in the Record of Decision following a review of the public comments received on the Remedial Investigation/ Feasibility Study report and the Proposed Plan.